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(54) Pedestrian safety module device

(57) A pedestrian safety device for automotive vehicles with a deployable hood (1) consists of a pedestrian safety module (2) beneath the leading edge (4) of the hood, and a hinge assembly (3) at the trailing edge (5) of the hood. The hood is latched to the module (2). In case of a pedestrian impact at the leading edge of the hood the module is mechanically released to rotate, so that the hood is lowered at the leading edge (4). Simultaneously the rotational impulse of the hood is used to uplift the trailing edge (5) of the hood. A two bar link (3) at the rear hinge assembly is released by the hood impulse and enables uplifting of the trailing edge of the hood, and locks the hood in a deployed position.

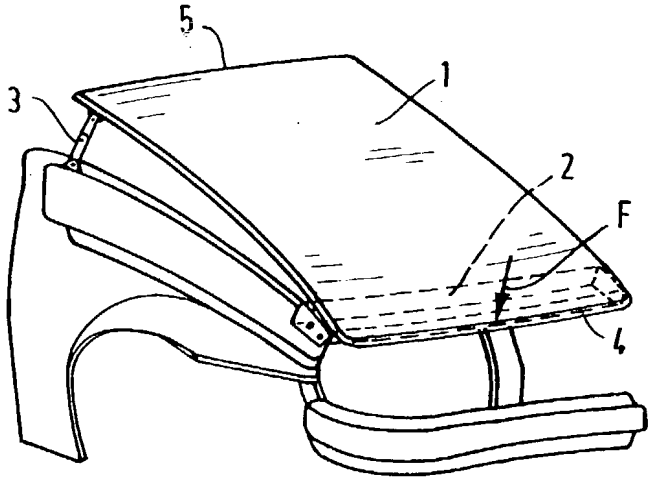

FIG.2

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Description

[0001] The present invention relates to a pedestrian safety device and in particular to a pedestrian safety device for automotive vehicles.

[0002] In modern motor car design, for visibility, aerodynamic and styling reasons, it is desirable that the hood line is kept as low as possible. As a result, there is generally very little clearance between the hood and the engine bay contents of the automotive vehicle. Consequently, the hood will provide very little cushioning effect when impacted by a pedestrian during an accident. Pedestrian safety performance can be improved by increasing the clearance of the hood. Therefore a device is necessary to raise the hood when impacted by a pedestrian.

[0003] EP 0630801 B1 discloses a vehicle hood which is hinged at its leading edge and which is releasable latched at its trailing edge. Both the hinge mechanism and the latch mechanism by which the hood is attached to the vehicle, are arranged to cause the whole hood to lift along its full length when the forward edge of the hood is impacted by a pedestrian during an accident. The hinge and latch mechanism disclosed in the above patent specification refers to a hood which is hinged at its leading edge, but it is not applicable to a hood which is hinged at its trailing edge.

[0004] Therefore, it is a primary object of the present invention to provide a pedestrian safety device for rearward hinged hoods, with non of the above mentioned drawbacks.

[0005] According to the present invention there is provided a pedestrian safety device for a rearward hinged hood, which will enable the leading edge of the hood to cushion the pedestrian impact whilst raising the trailing edge of the hood.

[0006] In accordance with the present invention a pedestrian safety device includes a hood being hinged to the vehicle body by means of a pair of hinge assemblies, said hinge assemblies being located at the trailing edge of the hood, the hinge assemblies uplift the hood in response to a pedestrian impact and lock the hood in a deployed position, whereby said hood is latched to a safety module at the leading edge of the hood, the safety module is designed as upper front cross-member, the safety module is attached to the body structure with two safety module pivots left-hand side and right-hand side of the module, in normal operating conditions rotation of the safety module around a vehicle transverse axis is restrained by two shear pins, which are located right-hand side and left-hand side of the safety module, each between safety module and vehicle body, both shear pins are located in front of the safety module pivots relative to the vehicle longitudinal axis, the dimension of a shear pin and the distance of a shear pin to a safety module pivot are arranged such that in case of a pedestrian impact at the leading edge of the hood the shear pins fail at a predetermined load so that the safety module is released to rotate around the vehicle transverse axis.

[0007] Bump stops are attached to the pedestrian safety module on its upper side at the rear edge, the bump stops also lie backwards to the said safety module pivots in such a way that in case of a pedestrian impact, when the safety module starts to rotate, the rear edge of the module hits the hood and lift it up, while the hood is pushed down by the pedestrian impact force at its leading edge, so that as a result the hood starts to rotate around a vehicle's transverse axis. Thus the leading edge of the hood is lowered during an impact which causes a cushion for the pedestrian during the accident.

[0008] The said hinge assembly has a lower hinge bar and an upper hinge bar linked together with a safety pivot, both hinge bars are restrained to rotate about the safety pivot by a shear pin, which is located between both hinge bars in normal operation mode, and the hinge bars are released to rotate about the safety pivot in a safety operation mode when said shear pin fail due to an overload during pedestrian impact. Then the hood can uplift with its trailing edge and the hood is locked by the hinge assembly in a position which is determined by the geometry of the hinge assembly.

[0009] The above and other objects, features and advantages of the present invention will become more apparent from the following description when taken into conjunction with accompanying drawings.

[0010] **Fig. 1** is a perspective view of the pedestrian safety device in normal operation condition in accordance with the present invention.

[0011] **Fig. 2** is a perspective view of the released pedestrian safety device with deployed hood in accordance with the present invention.

[0012] **Fig. 3** is a cross-sectional view of the pedestrian safety module in normal operation conditions.

[0013] **Fig. 4** is a cross-sectional view of the pedestrian safety module in deployed position.

[0014] **Fig. 5** is a cross-sectional view of the hinge assembly in normal operation conditions.

[0015] **Fig. 6** is a cross-sectional view of the hinge assembly in deployed position.

[0016] A perspective view of the pedestrian safety device is shown in Fig. 1. The module consist of a hood 1, a pedestrian safety module 2 and a rear hinge 3. The safety module 2 is located beneath the hood's leading edge 4 and it behaves as a conventional latch platform in normal operation conditions. The rear hinge 3 is located ate the hood's trailing edge 5, and also behaves in a conventional manner in normal operation conditions.

[0017] Fig. 2 shows the pedestrian safety device in deployed condition. During an impact between any position on the hood leading edge 4 and a pedestrian hip/upper leg, e.g. represented by force F, the impact energy is used to rotate the front end module 2, which in turn rotates the hood 1 about the module 2, and allows the hood leading edge 4 to progressively collapse. The ro-

tational impulse of the hood 1 is also used to release the rear hinge assembly 3 to a safety operation mode, where the geometry of the hinge assembly 3 changes and the trailing edge 5 of the hood 1 can uplift, hence lifting the hood 1 away from the engine hardpoints. This results in a lower load on the pedestrian hip/upper leg and a reduction in head injuries.

[0018] Normal operation condition details of the pedestrian safety module 2 are illustrated in the cross-sectional view of Fig. 3. The module 2 is attached to the body structure of the frontend with a safety module pivot 6, located around the centre of the module cross section. Rotation of the safety module 2 is restrained by a shear pin 7 or other structural means to prevent it from rotating and enable it to have a structural function in normal operating conditions. A rubber bump stop 8 is located towards the back edge of the module 2 and beneath the hood 1. A variation of this design may be incorporated into a Grille Opening Reinforcement assembly.

[0019] Fig. 4 shows the pedestrian safety module in deployed condition. During a pedestrian impact on the leading edge 4 of the hood 1, represented by load F, a clockwise moment is created about the pivot 6 of the savety module 2. At a predetermined impact load the shear pin 7 fails and the module is free to rotate. Other structural connections between the module and the body frontend structure may also be used to achieve the same operation or alternatively, a Grille Opening Reinforcement may incorporate an upper member that can rotate in this manner. The rubber bump stops 8 transmit this rotation directly into the hood stiffeners and hence begin to rotate the hood also in a clockwise direction.

[0020] The rear hinge in normal operating condition is shown in Fig. 5. The hinge joints are arranged so that the hood initially rotates around a first hinge pivot 9, attached to the body structure of the frontend, and then, if desired for additional access, around a second hinge pivot 10, attached to the hood 1. First and second pivots are connected by a lower hinge bar 11 and an upper hinge bar 12, with both bars linked at a safety pivot 13. The safety pivot 13 is restrained by a shear pin 14, connecting lower hinge bar 11 and upper hinge bar 12, or other structural means to prevent the rear edge of the hood lifting upwards during normal operating conditions.

[0021] The rear hinge assembly in deployed condition is illustrated in Fig. 6. The rotation of the hood 1, resulting from the pedestrian impact on the leading edge 4 of the hood 1 is transmitted to the rear hinge assembly via the hood inner sidemembers. This rotation loads the hinge assembly in the opposite direction to its normal operation. At a predetermined load the shear pin 14 fails and releases the safety pivot 13. The hinge assembly is then free to rotate simultaneously about the first and second hinge pivots 9, 10. The two hinge bars 11, 12 continue to rotate until the hinge bars are in line and then the upper hinge bar 12 toggles over centre to reach a position, characterised in that both hinges bars 11, 12 are slightly angled with the angle in the opposite direction compared to the normal operation condition. This locks the hood 1 in its raised position, which is in the area of the rear hinges approximately 100 mm above its normal operation position.

Claims

1. A pedestrian safety device including a hood (1), said hood (1) being hinged to the vehicle body by means of a pair of hinge assemblies (3), said hinge assemblies (3) being located at the trailing edge (5) of the hood (1), whereby the hinge assemblies (3) uplift the hood (1) in response to a pedestrian impact and lock the hood in a deployed position, **characterised in,** that

   - said hood (1) being latched to a safety module (2) at the leading edge (4) of the hood (1), the safety module (2) is designed as upper front cross-member attached to the body structure with two safety module pivots (6) left-hand side and right-hand side of the module, in normal operating conditions rotation of the safety module (2) around the vehicle transverse axis is restrained by two shear pins (7) between safety module and vehicle body, both shear pins (7) are located in front of the safety module pivots (6) in such a distance that in case of a pedestrian impact (F) at the leading edge (4) of the hood (1) the shear pins (7) fail and allow the leading edge (4) to lower, and,
   - bump stops (8) attached on the upper rear edge of the pedestrian safety module (2) rearward to the safety module pivot (6) initiate uplifting of the trailing edge (5).

2. A pedestrian safety device according to Claim 1, **characterised in,** that
   the said hinge assembly (3) has a lower hinge bar (11) and an upper hinge bar (12) linked together with a safety pivot (13), both hinge bars are restrained to rotate about the safety pivot (13) by a shear pin (14), which is located between both hinge bars in normal operation mode, and the hinge bars are released to rotate about the safety pivot (13) in a safety operation mode when said shear pins (14) fail due to an overload during a pedestrian impact.

3. A pedestrian safety device according to Claim 1, **characterised in,** that
   the said safety module is integrated in a grille opening reinforcement.

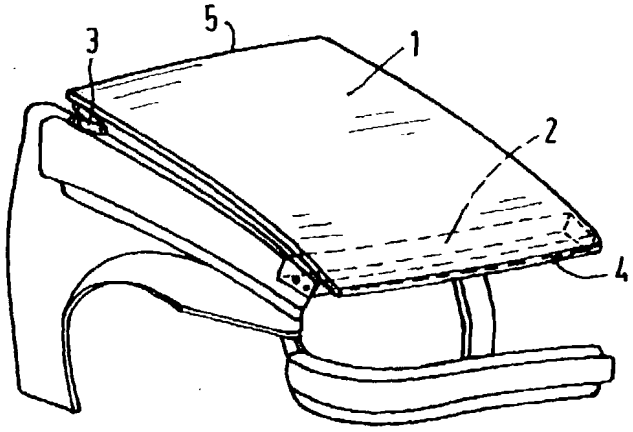

FIG.1

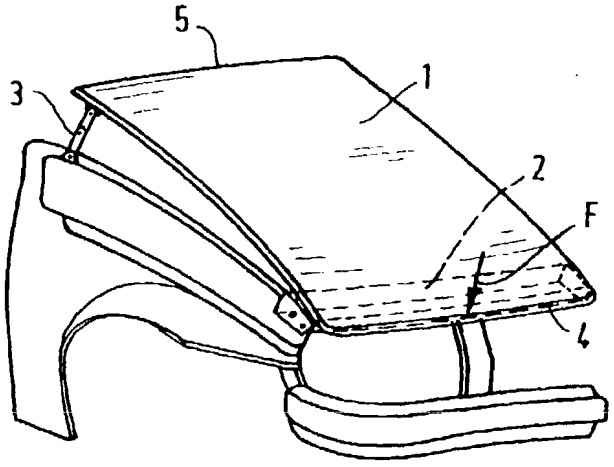

FIG.2

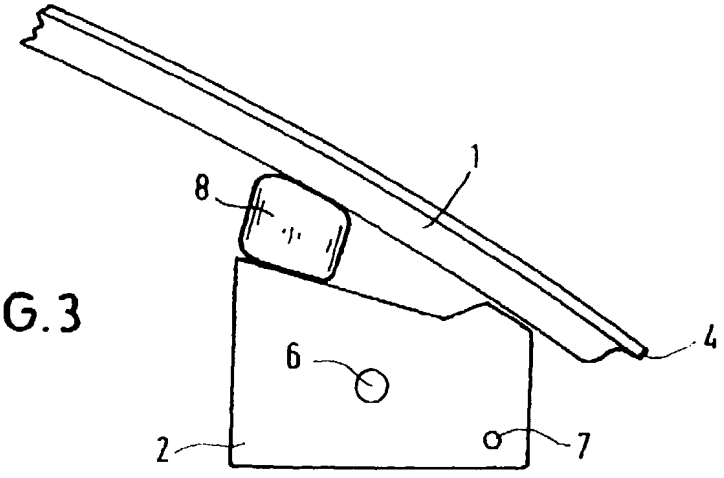

FIG.3

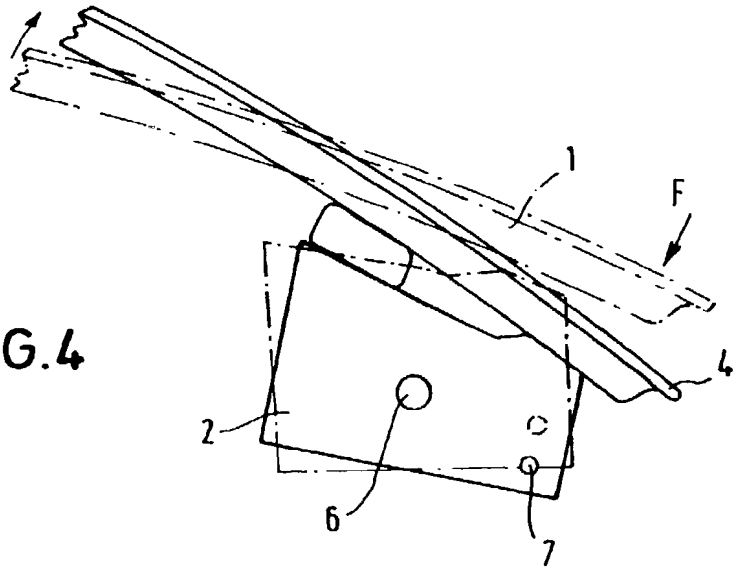

FIG.4

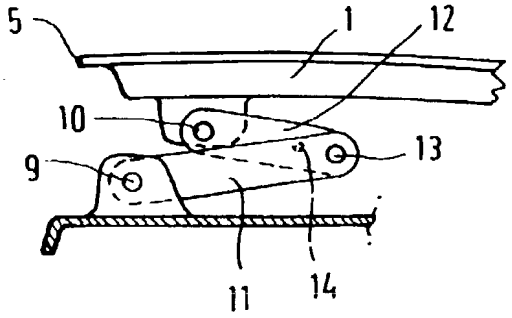

FIG.5

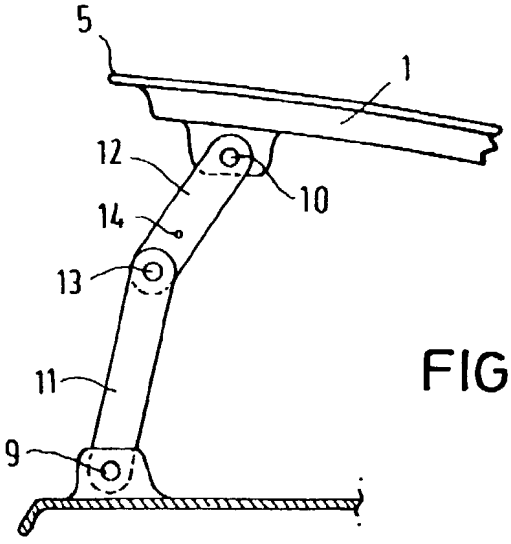

FIG.6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 11 6470

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 509 690 A (JAGUAR CARS) 21 October 1992 (1992-10-21) * column 3, line 57 - column 4, line 58; figure 6 * * column 3, line 9 - line 56; figures 4,5 *	1-3	B60R21/34 B62D25/12
A	PATENT ABSTRACTS OF JAPAN vol. 008, no. 076 (M-288), 9 April 1984 (1984-04-09) & JP 58 221773 A (NISSAN JIDOSHA KK), 23 December 1983 (1983-12-23) * abstract; figures *	1	
A	DE 197 10 417 A (BAYERISCHE MOTOREN WERKE AG) 17 September 1998 (1998-09-17) * column 2, line 51 - column 3, line 33; figure *	1,2	
D,A	EP 0 630 801 A (JAGUAR CARS) 28 December 1994 (1994-12-28) * column 3, line 49 - column 4, line 10; figure 4 *	1,2	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
B60R
B62D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 February 2000	Dubois, B

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15-02-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0509690 A	21-10-1992	DE 69206032 D	21-12-1995
		DE 69206032 T	05-06-1996
		DE 69221328 D	04-09-1997
		DE 69221328 T	04-12-1997
		DE 69226655 D	17-09-1998
		DE 69226655 T	07-01-1999
		EP 0644104 A	22-03-1995
		EP 0641707 A	08-03-1995
		JP 5112257 A	07-05-1993
		US 5437348 A	01-08-1995
		US 5385212 A	31-01-1995
		US 5263546 A	23-11-1993
JP 58221773 A	23-12-1983	NONE	
DE 19710417 A	17-09-1998	NONE	
EP 0630801 A	28-12-1994	DE 69400889 D	19-12-1996
		DE 69400889 T	06-03-1997
		JP 7069245 A	14-03-1995
		US 5697467 A	16-12-1997

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